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SPECIAL REPORT

THE Future OF THE Web

» If your company is like most organizations today, the Internet has become such an integral part of your operations — such a key aspect of how people work, communicate, share information, find information and buy or sell — that it's hard to imagine how you would operate without it, even for just one day. Over the course of the past dozen years or so, the widespread adoption of the Internet has ushered in truly dramatic change to many aspects of business. From offshoring to e-commerce, the Web has influenced an extraordinary range of issues in business strategy, organization and execution — and, in the process, has become an indispensable tool for 21st-century organizations. ■ But what does the future hold for the Web? Because most businesses are dependent on the Web for their everyday functioning, it's more important than ever to stay attuned to its continuing evolution, innovation and challenges. In this special report — the first of a series of MIT Sloan Management Review special reports on timely business issues — we've asked noted experts to explore a wide range of topics pivotal to the Web's future, from e-commerce to collaboration tools to some of the unsettling vulnerabilities inherent in today's Internet infrastructure.



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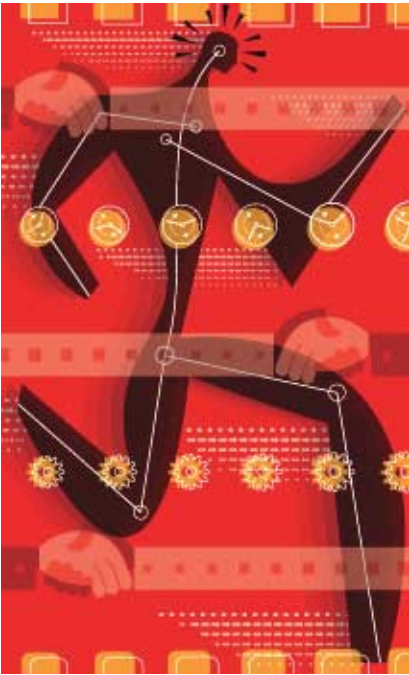
» VIEWS OF THE FUTURE

A variety of Internet pioneers, experts, participants and observers ponder what effect the technology will have on business, culture and society.

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BEYOND Enterprise 2.0

*You can bank on a tenfold improvement
in the cost and capability of collaboration
technologies over the next five years.
What will your organization do with that?*



Over the last decade, the Internet has transformed many aspects of the way business is conducted — from how goods are bought and sold to where work is done. To explore what might constitute the next generation of Web technologies and what effect they will have on the nature, purpose and management of organizations, MIT Sloan Management Review contributing editor Martha E. Mangelsdorf sat down with two leading experts: **Erik Brynjolfsson**, director of the MIT Center for Digital Business and the George and Sandra Schussel Professor of Management at the MIT Sloan School of Management; and **Andrew P. McAfee**, associate professor of business administration in the Technology and Operations Management Unit at Harvard Business School.

Looking ahead to the next year or two, what do you think are some of the most important ways in which the Web — and in particular so-called Web 2.0 technologies — will continue to change the way business is done?

BRYNJOLFSSON: I expect a big thematic change in the way people have been using the technology. Because of the recession in 2001–2002 and really, frankly, some overspending in the late '90s, there was for several years a focus within corporations on cost-cutting and using the Internet to save money, gain efficiencies and improve productivity. That was largely successful. But going forward, I think there's going to be more of an emphasis on using Web 2.0 technology to support innovation, creativity, collaboration and information sharing. When it comes to what CIOs are asked to focus on, there's a bit of a cycle that parallels the business cycle. Going forward over the next year or two, I see a focus on using the Web to grow revenues and foster innovation — as opposed to a focus on cutting costs.

McAfee: I think that's exactly right. There are several trends going on — some of which have been going on for some time, some of which have started to accelerate recently — that support this flowering of collaboration and innovation and creativity that we are seeing on the Web. One trend is that the cost of participating on the Web continues to plummet. Processing, bandwidth, storage and memory all just continue to get cheaper and cheaper. It's also getting a lot less expensive to contribute to the Web or to build an industrial-strength Web site.

In addition, expertise barriers to putting content on the Web have basically vanished. If you get a Blogger account, you don't need even basic HTML skills to start getting your thoughts up on the Web. Anyone with an Internet connection can play on the Web in all the ways they want to now. And that contributes to this flowering of innovation and creativity.

BRYNJOLFSSON: While it's true that everyone can weigh in on just about every topic on the Internet today, that doesn't mean everyone always should. For example, you don't have to be a climate change expert to edit the Wikipedia entry on global warming, but maybe Wikipedia would be better if people focused on areas where they had something to contribute.

Really, what we need is “meta-innovation” — innovation about ways to innovate.

We need innovation not just in the technology but innovation in some of the institutions that manage the collaboration and that manage a global community working on problems. The question is: Is there a way that we can create an institution or a set of institutions where the right answers emerge consistently from collaborative efforts?

McAfee: We don't have a lot of experience with how to do that. We're used to the forms of organization we've had for a long time. The Web — this worldwide, zero-incremental cost network that we've built — gives us a lot of opportunities. I think the innovators and the entrepreneurs going forward are the ones who realize how to seize that and build great institutions and organizations in the new environment.

I'm not saying that the complete level playing field that the Internet makes possible is a great idea in all cases. But the business opportunity it presents is to create the architecture of participation — the ground rules of the game — so that the good material emerges.

One place where we've seen Internet-based collaboration work effectively is open-source software development. Is that an interesting model for how this type of collaboration might play out in other industries?

BRYNJOLFSSON: It's very interesting and it's an example of a broader phenomenon that has sometimes been called the “gift economy.” There are a lot of knowledge workers who contribute what they have to offer not necessarily for purely

52% Agree

With the following:

By 2020, the free flow of information will completely blur current national boundaries as they are replaced by city-states, corporation-based cultural groupings, and/or other geographically diverse and reconfigured human organizations tied together by global networks.

“I think this is feasible, but not in the timeframe. Government regulation will slow the pace of this change as political constituencies fight to keep revenue sources local.”

PETER KIM
SENIOR ANALYST FOR
FORRESTER RESEARCH

“The world is flat, but it's also lumpy. We cluster together. Geography is one powerful attractor. So are interests. We're capable of maintaining many sets of relationships simultaneously.”

DAVID WEINBERGER
A WRITER AND TEACHER AT THE
BERKMAN CENTER FOR INTERNET &
SOCIETY

“There was a time that one could literally connect a computer to the Internet and be on — now one must register the IP connection, which means such a connection can be denied. It is not freedom when a corporation or government holds the key to the cage.”

SCOTT MOORE
ONLINE COMMUNITY MANAGER FOR
THE CHARLES AND HELEN SCHWAB
FOUNDATION

Source: A Web-based survey, “The Future of the Internet II,” published September 24, 2006, sponsored by the Pew Internet & American Life Project and conducted by Princeton Survey Research Associates International. Download the full report at www.pewinternet.org/pdfs/PIP_Future_of_Internet_2006.pdf

financial motives but because of a whole set of motivations psychologists can tell you we all have. You see this in open source, you see it in Wikipedia, you see it in the in-depth, really thoughtful reviews on Amazon.com or some of the travel sites.

We as a society are wealthy enough that most people don't have to spend every waking hour just getting food and sustenance. So we have the luxury to indulge some of our other interests and needs — including a taste for creativity that seems to be innate in most people.

McAfee: What we're seeing is just how deep-rooted that desire is to do several things: to share, to communicate, to get your expertise out there and to do what Ward Cunningham, who invented wiki technology, called "authoring." A lot of us have a deep urge to get our thoughts up there in a way that reaches an audience.

Let's talk a little bit about the process of how the good material — good content, good ideas — can filter up.

McAfee: When I talk to corporate audiences, I usually start with the technological mechanisms that let "good stuff" emerge. The Internet has a huge amount of structure because of the links between pages. And Google realized that and was able to harness that, which is why we perceive Google's results to be so good. If you let people author Web content and you let them interlink, the cream is going to rise to the top in a sense; the most popular content is going to be very evident very quickly.

With wikis and Wikipedia, the mechanism there that allows good ideas to emerge is that if I don't like your edit, I can undo it with one click. That means there's no point for you to spend six hours defacing my work, because I can undo your edits so easily. You have great incentive to be helpful, rather than harmful, if you want your contributions to last.

Brynjolfsson: The examples Andy is giving are examples of a broader phenomenon that Tom Malone, my colleague

at the MIT Sloan School, is calling "collective intelligence." Malone recently founded the MIT Center for Collective Intelligence to try to understand the common themes between initiatives like Wikipedia and Google. He points out that it's not just that Google has a clever search algorithm and some powerful servers; it's that there's a tremendous amount of structure in the Web itself that people create every time they add a link to one of their pages. That collective intelligence is what Google leverages so effectively. Ironically, most internal webs — intranets — don't have that same kind of cross-linking. As a result, the same algorithms are radically less effective internally than externally.

What would your advice be to managers about adopting Web 2.0 tools within their organizations?

McAfee: The first piece of advice I'd give is that you might want to rethink your infrastructure for collaboration and communication. Take a look at the new toolkit out there — things like blogs, wikis, tags and internal prediction markets. (Internal prediction markets allow employees to buy and sell stocks related to questions like "Will we sell over 50,000 units of Product X this quarter?") Think about what tools would make sense for your organization and how to get people to actually use them.

Which technologies, specifically, do you think are the low-hanging fruit for corporate executives to consider?

McAfee: The ones that I try to get managers excited about these days are those that let people express the desire they have to contribute or publish for a broad audience. If you want to dip your toe in the water, set up a few wikis, set up a few employee blogs. Watch what happens as a result. These are low-risk, low-cost experiments.

However, one huge fallacy of using Web 2.0 technologies within a corporation could be described as "if we build it, they

will come." That's the belief that if you set up some internal Web 2.0 infrastructure, then you're going to get great emergent phenomenon — an internal Google-level search and a Wikipedia-level internal collaboration environment. The main reason that doesn't happen is that the number of people who are actually contributing content to the Web — as opposed to passively consuming it — is a tiny, tiny percentage of all Web users. You scale that down to enterprise size, and there's essentially no one participating in what I call the Enterprise 2.0 — that is, the use of Web 2.0 tools within companies. The manager's job is to increase the ambient level of participation in and contribution to these Enterprise 2.0 environments.

How do you go about doing that?

McAfee: The economists would say you provide incentives to do it — whether hard or soft incentives, cultural ones or monetary ones. We can use the rich mix of managerial tools we have to get people to behave the way we'd like them to and do the things we'd like. One of the simplest and most effective techniques I've seen — and I've seen it over and over — is for a boss to just say, "I'm not reading any e-mails about this project; put all your information up on the wiki where we can all see it and use it."

Brynjolfsson: Paradoxically, some of the most powerful incentives can be created when you simply take away undue structure and constraints. And that's probably the class of incentives that's going to be most useful here. If people in organizations have more freedom to work laterally and diagonally and in all the other directions within their organization, then you're going to see more creativity and innovation. You're also going to see a lot more potentially useful connections emerge organically.

This doesn't come costlessly. One of the benefits of the organization of a corporation is the potential for streamlining and efficiency that hierarchy brings to

bear. Ultimately, it's a trade-off in terms of where you want to be on that creativity vs. efficiency spectrum. The nice thing is that innovations in technology and in organizational design are allowing us to push out the frontier of that trade-off, so that you can get more innovation without sacrificing efficiency to the same degree.

McAfee: I don't think Erik believes, and I certainly don't believe, that everyone should abandon hierarchy and abandon any element of command and control inside an organization. That would be a ludicrous thing to say. An existing company can take advantage of both the benefits of imposing structure and hierarchy and some level of managerial intervention while simultaneously getting out of the way in other areas and letting the lateralization and the diagonal innovation emerge. And I don't think that it's naive to expect that both of these phenomena can happen — just as it's not naive for an organization to have an ERP [Enterprise Resource Planning] system and a wiki at the same time.

Bryn Jolfsson: In fact, I think a lot of the ERP systems and the process-management tools that are often considered to be antithetical to wikis can be very complementary or synergistic with the collaborative tools. Andy and I are working on a paper now called "Scale Without Mass" that looks at how you can leverage creativity and new ideas through business process replication by

using tools like ERP and CRM [customer relationship management]. The idea is that when somebody comes up with an innovation, you can use these process-management tools to much more rapidly replicate and disseminate the new ideas throughout the company on a global basis. There are a number of examples of companies doing that. That is a good example of this trade-off between innovation and efficiency being much less severe than it used to be.

McAfee: We've got one set of tools that allow the good ideas to percolate up to the top, and then you can use these very structured process-management technologies to replicate the innovation. One way to think about managers' role in this era is that they grab the good ideas that percolate up and then propagate them throughout the organization — with brutal efficiency in some cases.

That's interesting. Can you give some examples of that phenomenon?

Bryn Jolfsson: When Amazon comes up with a better shopping experience for its customers, the improvement may involve changing a few lines of code or rearranging of some pixels — and, instantly, millions of people have a new shopping experience on each of their desktops, all over the world. Amazon is constantly doing experiments to see if the company can improve the shopping experience by a few tenths of a percent in

terms of the yield and efficiency. At a Web-based company, it's pretty easy to see how creativity can be quickly leveraged to millions of "store locations," if you will. The same thing is true for software firms or other companies that replicate their products and services digitally. But what we're beginning to see is that is happening more and more — even in industries that aren't purely Web-oriented. Andy did a fascinating study of CVS Corporation, a retail pharmacy chain based in Woonsocket, Rhode Island. CVS improved its business process for ordering prescription drugs and then, within the course of a year, replicated the improvement at more than 4,000 retail locations. That's something that wouldn't have been doable before firms had a technology platform already in place for implementing and disseminating the innovation.

In the CVS case, did that innovation come about through the use of Web 2.0 collaborative technologies?

McAfee: That particular innovation at CVS came from a cross-functional team brought together to solve a problem. What we're seeing more generally, though, is that a lot of clever ideas now are percolating up via some combination of people and technology — and then they're propagated throughout the organization. Companies in very turbulent, very information-intensive industries

56% Agree

With the following: By 2020, worldwide network interoperability will be perfected, allowing smooth data flow, authentication and billing; mobile wireless communications will be available to anyone anywhere on the globe at an extremely low cost.

"The Internet will have gone beyond personal communications [by 2020]. Many more of today's 10 billion new embedded micros [networked sensors and other devices using an Internet protocol] per year will be on the Internet."

BOB METCALFE
POLARIS VENTURE PARTNERS,
FOUNDER OF 3COM AND
INVENTOR OF ETHERNET

"I suspect there will be a global low-cost network in 2020. [However], there are various interests that have a vested interest in limiting interoperability in various ways, and they will in 2020 still be hard at work."

FRED BAKER
SENIOR TECHNOLOGIST AT
CISCO SYSTEMS, AND BOARD
MEMBER OF THE INTERNET
SOCIETY

Source: "The Future of the Internet II," Pew Internet & American Life Project. Download the full report at www.pewinternet.org/pdfs/PIP_Future_of_Internet_2006.pdf

56% Agree

With the following: By the year 2020, virtual reality on the Internet will come to allow more productivity than working in the real world. But the attractive nature of virtual-reality worlds will also lead to serious addiction problems for many.

"The way the question is worded embeds some assumptions. I have a serious addiction to reading; is that a social problem? Has the world 'lost' me?"

HOWARD RHEINGOLD
AUTHOR AND SOCIOLOGIST

"I'm not sure if addiction is the right word, but the shift of people's attention to online information, media, entertainment and communities will erode culture and bring into being a colder if more efficient world."

NICK CARR
WRITER AND CONSULTANT

49% Disagree

With the following: As sensing, storage and communication technologies get cheaper and better, individuals' public and private lives will become increasingly "transparent" globally.

"The most important thing about transparency is it shows how transparent people have already been, all along, to the institutions that mean to control them."

DOUGLAS RUSHKOFF
SOCIAL THEORIST, JOURNALIST AND TEACHER, NEW YORK UNIVERSITY

"The cost of unlimited transparency will not simply be privacy. It will be autonomy, freedom, and individuality."

MARC ROTENBERG
EXECUTIVE DIRECTOR, ELECTRONIC PRIVACY INFORMATION CENTER

Source: "The Future of the Internet II," Pew Internet & American Life Project. Download the full report at www.pewinternet.org/pdfs/PIP_Future_of_Internet_2006.pdf

tend to be the ones that have gone the furthest with deploying the new Enterprise 2.0 infrastructure and the mindset that goes along with it.

BRYNJOLFSSON: In addition to structural changes, there are also some softer, cultural things that companies can do. Google, for example, has a norm that all employees are supposed to spend about 10% of their time on new ideas that aren't related to Google's main products. The company gives employees remarkable freedom as to how unrelated those projects and ideas can be. That's something that Google can afford to do in part because the company has been successful, so a real test would be whether a company that didn't have margins like Google's could afford to offer that kind of freedom.

McAfee: I've also talked to a few different professional services firms about the Enterprise 2.0 phenomenon. Like Google, those firms are also very successful, very high-margin businesses. But the soft shift — the cultural shift for them — they're finding difficult to execute, in part because their focus for so long has been on billable hours and on classic notions of productivity and output. And I think that neither Erik nor I see any technology that will by itself resolve that dilemma.

One of the things that I find interesting about these technologies is that you can draw the boundaries around them wherever you want. Use them purely for one lab or one work group — great. Or use them companywide — great. Include all of your customers, suppliers and users — great. With these technologies, you can very easily select the scale of community you want.

My colleague Karim Lakhani and I are writing a case study right now about Cambrian House Inc., a software development company based in Calgary, Alberta, that's drawing the boundary very widely. The company leaders have stopped saying they know what software

they should develop next. Instead, they have a suggestion board [open to the public] where anyone who wants can post an idea for a piece of software that they think will be successful and in demand. Cambrian House has a tournament and votes on the ideas submitted every month. The company commits to at least test the products that win — to build them to the point where the company can see whether the products will succeed in the market. Cambrian House will give each month's tournament winners some share of any future profits on that software product. The company also partitions out the coding tasks not only to its own employees but also to the community of people who know about the company and come to its site; the company offers these outside coders a share of the product's profits. Cambrian House is partially outsourcing both idea generation for new products and then product creation. What the company does is sit in the middle, coordinate all those activities, get the software to market and then partition out the proceeds that result.

So they've essentially viewed their core competency as managing their community.

McAfee: Exactly.

BRYNJOLFSSON: In general, the whole concept of internal and external [to the corporation] is becoming a lot blurrier. And that's again, partly, because of these kinds of tools. Part of this goes back to the basic economics about what it means to be an employee. For example, it's difficult for an assembly-line worker at General Motors to create value at home, without access to the company's capital equipment. But 150 years ago, craft workers did work with their own capital, and they had a lot more autonomy and independence. It was often blurry as to whether you'd say they were working for a firm or working for themselves. Today, in many ways we're coming back to that

type of arrangement, where knowledge workers, who work with their own human capital and perhaps access to the company's technology infrastructure that they can easily get from home, can create a tremendous amount of value for a company. Employee/independent contractor distinctions are less relevant for that kind of worker and that kind of firm.

The traditional corporate organization was tremendously successful throughout the 20th century. But, as we said at the outset, the technology innovations are engendering a whole set of complementary innovations in organizations. The traditionally sharp distinction between markets and firms is giving way to a multiplicity of different kinds of organizational forms that don't necessarily have those sharp boundaries.

McAfee: Some people who get really enthusiastic about the new Web technologies say that they render managers obsolete, or that we are going to have a completely self-organizing economy. But what we're saying is that we find that these changes actually heighten the role of managers and executives, who need to think about how to organize and compete in the new environment. And this implies another really interesting set of issues and challenges for management: thinking about what they want to have inside the boundary of their own firm versus what they want outside.

Brynjolfsson: It's not a question of complete decentralization or complete centralization. Instead, we see companies simultaneously using centralization and decentralization in different aspects of their businesses. I've learned a lot from Andy's case study about Zara, the fashion retailer that is part of the Inditex Group, based in A Coruña, Spain. Zara's example highlights how even a light touch of technology can radically change the way a company or an industry works.

McAfee: Erik and I both find Zara a really interesting company. In a very vertically disintegrated industry —

apparel manufacturing and retailing — where everyone else outsources to low-wage countries, Zara is very vertically integrated. The company controls warehouses, cutting facilities and distribution centers and owns its stores. Zara's management pursues that strategy because they want the company to be fast, and they want to react to changing fashion trends in a couple of weeks — as opposed to in six months. As a result, they use a really interesting mix of centralization and decentralization. In particular, Zara has decentralized decisions about which clothes should be in each store. Headquarters decides what goods are available, in what quantities and at what price, and transmits this information to all the stores twice a week. The stores then decide what they actually want and use the same technology to transmit those decisions to headquarters, where the decisions are all added up. Then headquarters puts the products on trucks and sends them to the stores. There's this constant back and forth of information that helps the designers at Zara come up with the right new models and then get them into the right stores.

It's clearly another form of collective intelligence. While many companies in Zara's industry rely on very sophisticated software, genius designers or marketing to forecast or create demand, Zara does essentially none of that. The company in effect says, "Store managers, you tell us what people are going to wear for the next few weeks; then we'll build it and get it to you."

Brynjolfsson: This example highlights a trade-off between local and central knowledge that exists in every industry. And technology is allowing companies to move that knowledge back and forth much more rapidly. What you want to do is match the locus of decision making with the place that has the relevant knowledge, as well as make sure people at that location get any other pieces of knowledge they need. In Zara's case,

those local store managers have on-the-spot information that would be impossible for someone at headquarters to really understand. It's even almost impossible for the local store managers to communicate it, because there's so much subtlety to it. On the other hand, what can be communicated pretty easily are production schedules and availability.

McAfee: As Erik notes, one of the golden rules of organizational design has been to always line up the decision rights with the relevant knowledge. Is that knowledge quantitative or qualitative? If it's quantitative, we can ship it to headquarters and analyze it. If it's qualitative, is it distributed? Does it have to remain distributed? The new technology toolkit gives managers a lot of options for thinking through that golden rule.

Brynjolfsson: In many dimensions, it's very difficult to make predictions about the next five years. But the technology side is oddly predictable. We're quite confident that we're going to have a continuation of Moore's Law on the processor side and comparable improvements in memory, communications speed and storage. That means that the bottleneck — the real place where there's room to make excess returns if you're an entrepreneur or a manager or a venture capitalist — is in finding creative ways to use those technologies. Bank on a tenfold improvement in the next five years in most of those technologies I just mentioned. Now ask yourself: What will you be able to do differently given that tenfold improvement in cost or capability?

We are very far from exploiting the full potential of the technology. The set of technologies we have floating around today are fodder for at least a decade or two worth of organizational innovations — let alone the tenfold improvements we're going to see in the next five years.

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HOW Secure IS THE Internet

Given its increasingly integral role in business and society, the Internet's security flaws are troubling, to say the least.

For businesses, the Internet continues to represent a tool of great potential in areas as diverse as cost-cutting, collaboration and retailing. But there's a big, potential problem with the increasing reliance by business on the Internet. A 2005 report submitted to President Bush by the President's Information Technology Advisory Committee described the problem bluntly: "The information technology [IT] infrastructure of the United States, which is now vital for communication, commerce and control of our physical infrastructure, is highly vulnerable to terrorist and criminal attacks." ■ According to Tom Leighton, a professor of applied mathematics at MIT as well as co-founder and chief scientist of Akamai Technologies Inc. — a developer of techniques to handle Web interactions based in Cambridge, Massachusetts — the difficulty lies in the very design of the Internet. Leighton, who served on PITAC and chaired its subcommittee on cyber security, explained that the Internet protocols used today were in many cases built on top of the original Internet protocols developed almost 40 years ago. And the



security needs of the Internet in those early days — when it was used by only a small number of trusted researchers at places like government labs and a few universities — were very different from those of today’s massive global network. “The [Internet] protocols that were developed then were developed in an environment of trust,” Leighton explained. “There were only a few people using the Internet back then, and they were very knowledgeable and very trustworthy.” Times have changed. “Now we have a situation where we have tremendous adoption and use of the Internet and the Web — with very little security,” states Leighton. This vulnerability, according to him, has implications not only for businesses but also for national security.

Leighton should know about Internet security issues. Akamai operates what is known as a “content delivery network” — in essence a worldwide, decentralized network of servers that hosts Web sites for other organizations and delivers their Web content and applications. For example, if a site using Akamai’s services receives a large spike in traffic, that traffic can be distributed throughout the network of servers so that the site’s operation is not disrupted.

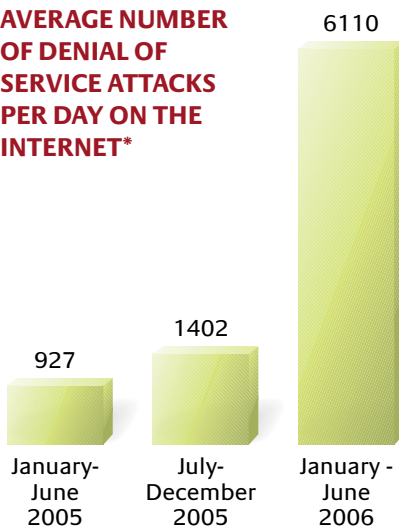
What does Leighton see as some of the big security threats facing the Internet? In addition to the more well-known threats such as viruses and “phishing” (the practice of sending bogus e-mails purportedly representing a business in an attempt to get access to a person’s password and account), Leighton described the following problems:

- Denial of service attacks. In a “denial of service attack,” a Web site’s IP address is bombarded with traffic in an attempt to overwhelm the infrastructure managing the site. “Bad guys,” Leighton explained, can use armies of “bots” — computers controlled, often unbeknownst to their owners, after having been infected with a virus or worm — to launch denial of service attacks. Such an attack can be targeted at a com-

FURTHER READING For a sobering assessment of the vulnerabilities of the Internet and related infrastructure, read the 2005 report *Cyber Security: A Crisis of Prioritization* by the President’s Information Technology Advisory Committee: www.nitrd.gov/pitac/reports/20050301_cybersecurity/cybersecurity.pdf

pany or more broadly. For example, InformationWeek reported on February 6, 2007, that on that day a denial of service attack “nearly took down” three of the Internet’s 13 so-called root servers, temporarily slowing the three servers. Though the attack did not have a significant effect on Internet endusers, what would happen if a denial of service attack ever actually succeeded in bringing

AVERAGE NUMBER OF DENIAL OF SERVICE ATTACKS PER DAY ON THE INTERNET*



*As observed by Symantec Corporation
Source: Symantec Corporation

down all 13 of the Internet’s root servers? Were that ever to occur, it wouldn’t take long before “your browser wouldn’t be able to go anywhere; you wouldn’t be able to send e-mail. Nothing on the Internet would work,” Leighton said.

- “Pharming.” “Pharming,” Leighton explained, often exploits a weakness in the DNS, an Internet protocol that allows a “bad guy” to tell a device known as a name server, of which there are millions, that it owns the IP address of an organization such as a financial institution. The hacker will then receive the traffic from that name server meant to go to the fi-

nancial institution, and the hacker can then send that traffic to a bogus Web page that looks like the financial institution’s own sign-in page. In the process, Leighton explained, criminals can gain password and account information. What’s more, the user may not realize what has happened. Leighton added that another type of “pharming” can use a different Internet protocol, known as the BGP protocol, to siphon off some of the traffic intended for a given site to a bogus site, again in an attempt to gain password and account information.

More troubling still are the larger implications of these techniques if applied against a nation rather than for commercial gain. For example, Leighton noted that one worry is if terrorists could gain account and password information to access critical infrastructure, such as the nation’s utilities system.

What can be done? The PITAC report made a number of recommendations, including increasing federal funding for long-term, fundamental research on cyber security issues. Leighton noted that, if the U.S. government were to fund research to develop more secure protocols to replace those currently used on the Internet, the government could then lead the way by adopting the improved protocols for its own use. That, in turn, would hopefully lead to wider adoption of improved Internet protocols and to a more secure, reliable Internet infrastructure.

“It seems to me that we’re not taking the steps needed to fix the problem,” says Leighton. “But I think it could be done.”

— Martha E. Mangelsdorf

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3. Critical Issues IN INTERNET RETAILING



Timothy M. Laseter,
Elliot Rabinovich,
Kenneth K. Boyer
and M. Johnny
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In the early, hyped-up days of e-commerce, Internet retailers tried to focus customer and investor attention on the bells and whistles of their product offering or Web pages, and hoped that no one noticed the poor performance of backroom operations — or they deluded themselves into believing that good execution was unimportant. But that approach resulted in late shipments and bloated fulfillment costs, which led to the demise of erstwhile leaders such as Pets.com, Webvan and Value America. In contrast, successes like Amazon.com invested heavily in building operations capabilities rather than outsourcing anything that didn't appear sexy enough for the “new economy.” ■ Internet retailing now has completed the cycle from overhyped promises to overreactive retrenchment and has settled into a steady but heady growth pattern. Online retail sales in the United States exceeded \$85 billion in 2005, and in 2006 they appeared to be on track to grow at around 24%.¹ This would mark the fifth straight year at that rate, which is more than three times the growth rate of total retail sales. ■ With e-commerce sales now accounting for large shares of seven retail

categories — over 40% in computer hardware and software and around 17% of music and video sales² — consumers have become increasingly pragmatic in their purchasing decisions. This sustained increase in Internet sales has been accompanied by an increased focus on operations execution.

The growth in online retail sales can be explained not only by the emergence of “pure-play” Internet retailers but also, to a large extent, by the entrance of multi-channel players — traditional brick-and-mortar retailers leveraging their brands and hopefully their physical infrastructures to compete on the Web. “Big-box” retailers such as Office Depot and Staples each generated more than \$3 billion in Web sales in 2005. And even 114-year-old Sears ranks among the top 10 Internet retailers (largely due to its 2002 acquisition of cataloger Lands’ End), according to *Internet Retailer* magazine.

With the increasing maturation of online commerce, many Internet retailers now face important inflection points in their operations strategy. Managing Internet retail operations will increasingly involve more than simply managing costs. It will require an understanding of the unique challenges of the category and target market — as well as the individual product and customer. Each of these factors produces a different cost-service tradeoff and, accordingly, different “right” answers. More complex still, the answers will keep changing as the online channel grows, customer expectations evolve and operational options expand.

Going forward, there are three critical operations issues facing these retailers. (See “About the Research.”)

1. How should returns be managed to achieve immediate customer profitability

About the Research The insights offered in this article draw on the research of the four coauthors, including work done collectively and separately with other collaborators. One source of the research has been our work with the business members of the Last Mile Supply Chain Center at Michigan State University (see www.lastmile-supplychaincenter.org). Center members include the online divisions of traditional retailers (such as OfficeMax and Albertsons), pure-play Internet retailers (such as Net-grocer.com and 1-800-PetMeds) and infrastructure providers (such as Newgistics and Descartes Systems Group). We have also worked with several other retail industry players to develop teaching cases and as consultants. Although our specific research interests vary, we share a common emphasis on empirical research. We regularly employ survey techniques to understand perceptual issues, but increasingly we seek to mine actual transactional data from company records in our research. Our goal is to employ rigorous analytic techniques to address the real-world operational problems facing the online retail industry.

and long-term loyalty?

2. Is the structure of the physical distribution network optimal?

3. Where should product inventories be deployed across the network for the best cost and service combination?

Manage Returns to Enhance Loyalty and Profits

Returns occur more often and thus play a more critical role in Internet retailing than in traditional brick-and-mortar retail. Some “commodity” or “hard-good” items, such as books or CDs are fairly easy to search for and examine online and, therefore, do not require liberal return policies for customers to feel confident about their purchases.³ However, since customers generally cannot examine online purchases until after the item has been paid for and delivered, return rates can run as high as 30% for some Internet retailers selling specialty items, such as apparel, and many currently feel compelled to offer free returns to compete with traditional retail options.

Many companies have turned to specialists to handle the overwhelming returns problem. For example, returns

management firm Newgistics Inc., headquartered in Austin, Texas, and customer support specialists Global Response, headquartered in Margate, Florida, provide networks of facilities and an infrastructure for “reverse logistics” — that is, the shipment of goods back to the source. By focusing on their specific tasks and sharing facilities across multiple clients, these specialists offer faster execution and economies of scale. But crediting the customer and recovering the goods still leaves open the question of whether to return the goods to stock or to dispose of them through alternative, discount channels. Online sellers with offline retail presence, such as electronics retailer Best Buy Co. Inc., have an advantage in this regard over pure-play online retailers. They can easily leverage their existing infrastructure to offer customers the potentially more convenient option of returning online purchases to the brick-and-mortar stores, while affording themselves the often cost-saving option to aggregate returns and send them back in bulk to regional or national distribution centers for restocking, refurbishing or scrapping.

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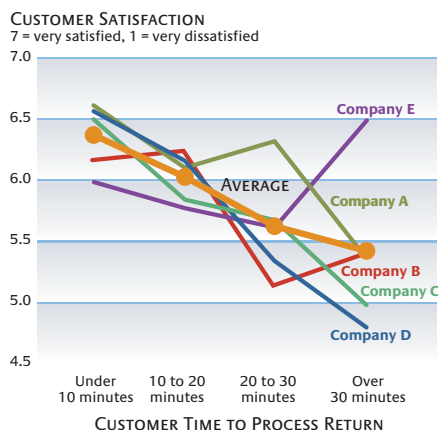
Ephemeral demand and potentially sullied products present obvious operational challenges for Internet retailers, but the handling of customer transactions has much broader consequences. Our recent survey of more than 400 customers of five Internet retailers covering a range of product categories found a strong, positive link between both the returns transaction and the returns policy and customer loyalty. Customers who spent less time in preparing their returns and waited shorter amounts of time to receive their refunds indicated far more satisfaction and loyalty than those who had to take more time and wait longer. (See “The Relationship Between Customer Time and Satisfaction.”)

The study also underscored the point that prior service experience shapes the customer’s expectation, reinforcing the importance of repeatable operations excellence in maintaining customers.⁴ Specialty retailer Frederick’s of Hollywood Inc., headquartered in Los Angeles, California, understands this.

In addition to a standard returns process, it offers customers a premium service for returning Web site purchases through Newgistics and other outside

THE RELATIONSHIP BETWEEN CUSTOMER TIME AND SATISFACTION

Less time needed to process the return of an order is directly correlated with higher customer satisfaction, according to a recent direct survey of more than 400 customers of five Internet retailers.



service providers, which minimizes consumer effort in preparing the return and expedites refund processing.

Order execution is another important way for Internet retailers to improve returns management. The best place to prevent a return is at the point of purchase. For instance, eBags Inc. — the leading online retailer of luggage, brief-

cases, backpacks and handbags, based in Greenwood Village, Colorado — continually expands its product views and provides more detailed product specifications and customer usage ratings to improve the initial selection decision.

Besides improved execution, structural factors must be taken into consideration. Our ongoing research with a consumer durable goods retailer has found that the more expensive an item, the greater the likelihood it will be returned. Just as the effort of preparing a return influences customer loyalty, the money at stake also affects the likelihood that a customer will bother to mail back the item. Initial research also suggests that for a given price level, a customer is less likely to return a bulky item than a smaller, easy-to-handle product.

Less intuitively, goods with lower sales have higher return rates. That is, after controlling for other factors such as price and size, we found that customers return popular items less often than they do items that sell infrequently. For retailers, this effect represents a form of double jeopardy in which the most returns occur with the products least likely to be resold, thereby generating higher average inventories and cost-to-serve.⁵

“There’s a lot of co-processing going on. You look at kids now ... they’re at their computers, they’ve got six windows open, they’re chatting, they’re watching. And I think that has some really interesting ramifications [for online content]. ... One is: How much of your brain is watching any one thing? And what does that mean for content?” — **LAURIE DEAN BAIRD, DIRECTOR OF TECHNOLOGY PARTNERSHIPS, PLATFORM R&D, TURNER BROADCASTING SYSTEM INC.**

“We’ve come to a point where the collective — the people that are out there, you all, us all — can edit content and create content and can tag content and say ... ‘Oh! I like this!’ or ‘I don’t like that,’ and it changes how that content is viewed by everybody in the group. ... We’re all kind of working together to create content, and we’re all kind of working together to edit it and then we’re all kind of working together to view it and say whether we like it or not.” — **JOSE CASTILLO, THINKJOSE.COM**

“For me the biggest single difference between Web 1.0 and Web 2.0 is that today you tend to get 46-year-old CEOs in Web 2.0 companies, whereas in Web 1.0 companies you got two 23-year-old co-CEOs. ... People are older, wiser and, to some extent, a little bit more jaded.”

— **JOSEPH B. LASSITER III, PROFESSOR OF MANAGEMENT PRACTICE AT HARVARD BUSINESS SCHOOL**

This preliminary finding offers contradictory evidence to the emerging theory of “the long tail,” which suggests that Internet retailers can profit by pursuing the fragmenting tastes of the consumer base and by offering a broader range of products.⁶ If more options enable greater “fit” for consumers, why do consumers return the less popular items more frequently after inspecting them? And more critical still, do returns and potentially other handling costs make these items even less profitable for retailers?

Further, return rates drop the longer an item is offered on a Web site (holding constant other product characteristics, such as price and popularity). This effect may be partially explained by the systematic discontinuation of low-selling items. But it also raises questions about the appropriate level of “churning” — the common retail practice of changing product offerings frequently. New items may attract more customers, but they come with a higher risk of return than older products.

Companies clearly need to understand product characteristics that drive returns, but they also should identify what we call “devil customers.” One company had regular customers who would order \$10 worth of products they wanted, plus another \$40 of undesired products so they could obtain free delivery for a \$50 order. These customers would then return the \$40 of unwanted products. Because the vast majority of customers behave fairly and reasonably, companies can structure return policies to allow their customer service representatives to go the extra mile for honest customers while stopping such egregious abuses.

Moreover, “devil customers” who take advantage of promotions and low-price deals prove fairly insensitive to the time needed for refunds or replacements. So even when approving returns from these customers, savvy Internet retailers can better manage cash flow and profits by giving priority to the customers who

contribute to higher margins and show greater loyalty.

In sum, our research points to five principles that will continue to drive better returns management.

1. Keep the interaction simple to minimize customer effort. Customer effort is the single most important driver of returns satisfaction.

2. Provide multiple options for returns where possible. Some customers are happy to perform the transaction completely online, while others want to talk to a human operator.

3. Communicate clearly to set expectations. Customer expectations cannot be exceeded unless the company first sets them, then keeps the customer apprised in order to achieve a “no surprises” relationship.

4. Measure and manage. Track returns to identify the problem products and the “devil customers.” Neither can be addressed unless it is first identified.

5. Operate consistently and treat customers fairly. They will reward you.

Develop an Optimal Network Structure

Internet retailers have structured their physical distribution networks in a wide variety of ways, primarily as a function of strategic intent and scale. Some develop distribution competencies in-house, while others depend heavily on outside service providers. The number and geographic location of fulfillment centers also varies, from a single location driven by happenstance to multifacility, global networks strategically designed to optimize cost and service.

Andrew Westlund, former vice president of Global Operations for Amazon.com Inc., explained that company’s early decision to vertically integrate into physical distribution by arguing that no fulfillment vendors in the late 1990s really knew how to manage Internet fulfillment operations.⁷ Amazon’s strategic decision to integrate forward vertically and commit to operations ex-

“The average length of an audio podcast is 22 minutes, so it’s about the size of a half-hour television or radio segment minus the ads. The average length of consumption is three minutes. The average video podcast is seven-and-a-half minutes. The average length of video podcast consumption is one minute. It doesn’t mean that they [users] aren’t enjoying the consumption of that content; what it does mean is that they are ‘snacking’ their way through the content.”

— **ALEX LAATS, CHAIRMAN AND CEO OF PODZINGER, A SUBSIDIARY OF BBN TECHNOLOGIES**

“There’s been a sea change in how you develop software, particularly in the consumer Internet. Cycles are now measured in ten days ... or even shorter; we’ve been known during periods of our development to push the live site up seven, eight, nine times a day, even. ... I think that’s kind of the general trend. The challenge for all of us — or for all of the engineering managers and product managers — is to figure out how to let that be a process that’s only semichotic...”

— **ANTONIO RODRIGUEZ, FOUNDER AND CEO, TABBLO INC.**

“What’s going on with video [on the Web]? ... What you’re going to see beyond YouTube is a whole new set of programming from new producers, new programs and new networks. ... You’re going to see all new producers and, then, more important, you’re going to see existing professionals move to the Internet, where they can have a direct relationship with users.”

— **JOHN FURRIER, CEO AND FOUNDER OF PODTECH NETWORK INC.**

cellence allowed the company to maintain customer service levels during the 1999 holiday season while other Internet retailers experienced meltdowns. During the following years, Amazon, which is headquartered in Seattle, Washington, closed and opened facilities in a continual quest to find the best footprint, evolving from a single backroom operation to a network that currently encompasses 17 fulfillment centers within the United States and another half-dozen facilities outside the United States.

Several different considerations can drive a company to move from a single facility to multiple sites. Most obviously, as an Internet retailer expands its geographic scope, the resulting need to lower transportation costs and speed delivery can drive it to open additional facilities that are closer to customers. Less obviously, product characteristics can influence the network structure. Small items can be shipped cheaply even over long distances, while outbound delivery of large, bulky items costs more. Complicating the decision making is that large items are more likely to achieve good inbound shipping econo-

mies, even to multiple facilities. All these issues need to be examined by retailers in the context of their business, products and demand characteristics (see "Tradeoffs in Designing a Distribution Network").⁸

Without the funds to build their own networks, smaller firms have outsourced fulfillment, thereby converting significant fixed costs to a variable cost. Finding a capable outsource provider can be difficult when the product requires specialized handling, however. For example, pet pharmacy 1-800-Pet-Meds, owned by PetMed Express Inc., operates out of a single, in-house fulfillment center in Pompano Beach, Florida, far from most large centers of population in the United States. Although such a location would produce a significant cost disadvantage in many retail categories, it works for 1-800-PetMeds because most of the company's shipments are sent via U.S. Postal Service Priority Mail, which is priced at a flat rate regardless of the shipping destination. The special staffing and controls required for the handling of prescription medicines also pushed 1-800-PetMeds to keep fulfillment in-house.

At the other extreme of distribution networks, eBags avoids the backward integration model and instead asks its original equipment manufacturer suppliers to provide fulfillment service through drop shipping. The luggage suppliers that provide products to eBags, such as Samsonite Corp., already operate multiple fulfillment centers dispersed around the country. Luggage producers typically serve small luggage retailers via United Parcel Service shipments (unlike many other manufacturers' distribution centers,

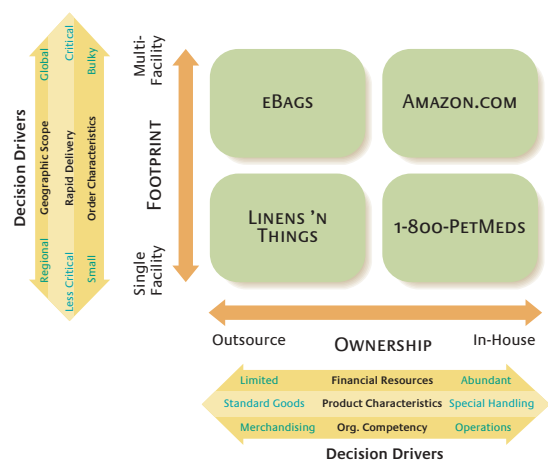
which handle only full truckload shipments). For this reason, OEMs can offer drop shipping at a lower cost and better service level than eBags could do on its own. This service has allowed eBags to operate only a minimal fulfillment infrastructure for some select (mostly private-label) product lines and instead to focus on integrating its suppliers through advanced information systems, including a sophisticated package tracking system and supplier performance reporting process.

The choices for a traditional retailer with a growing online presence prove no less daunting. Consider Clifton, New Jersey-based Linens 'n Things Inc., the second-largest retailer of home goods in the United States. Despite operating three distribution centers to serve its network of over 500 stores across North America, the company chose to outsource fulfillment operations of its \$70 million online operation for LNT.com to .Com Distribution Corp., which operates a 300,000-square-foot facility in Edison, New Jersey. The outsourced facility, which LNT.com shares with other customers, offers economies of scale while allowing Linens 'n Things management to focus on the larger business and their core merchandising capability.

With such a wide variety of options, the appropriate network architecture is anything but obvious. Furthermore, the optimal answer changes over time as online retail sales grow in importance. Consider the example of Borders Group Inc., a \$4 billion retailer of books headquartered in Ann Arbor, Michigan. In April 2001, Borders outsourced its Web site and fulfillment operations for Borders.com to Amazon. The difficulties of managing a separate online channel seemed disproportionate to the relatively small revenue it generated as an overall percentage of sales (less than 1% at the time of the agreement). However, strategic dynamics change over time. Borders is seeking to increase the use of interac-

TRADEOFFS IN DESIGNING A DISTRIBUTION NETWORK

Online retailers must consider multiple factors in the design of their physical distribution networks. When making critically important decisions on ownership and footprint, e-retailers must factor in six drivers, the sum of which will be almost unique for different companies.



tive marketing via the Internet, but it finds the formerly logical outsourcing decision a constraint. Although still cost-effective, the current model limits Borders' ability to capture the customer directly online.

Despite these examples, our research shows that, in many cases, the supplementary benefits offered by external partners prove very attractive to Internet retailers. These benefits normally translate not only into broader fulfillment network footprints but also into more

garding inventory deployment. Our recent study of online retailing profitability showed that excellent purchase fulfillment generates larger gross margin. In the case of one particular Internet retailer, a one-day reduction in delivery lead time implied an 8% to 18% improvement in gross margin.¹⁰ Achieving more rapid delivery depends upon inventory availability — not only in terms of quantity but also in terms of where such inventory exists within the supply network.

“split shipments” rank as one of its most critical operational cost drivers. For example, it may minimize delivery costs by shipping a single package with two items from Nevada to Georgia rather than shipping one package from Delaware and another from Kentucky. Although not a normal practice, Amazon could also delay the order and make a bulk transshipment between two facilities.

Our own research on inventory deployment for Internet retailers has highlighted these tradeoffs in supply

Clearly no “one-size-fits-all” network structure applies to Internet retailers. What's more, the “right” answer will keep changing if Internet retail sales continue to grow at 25% per year. The decision ranks among the most critical of strategic issues.

complete and reliable fulfillment services.⁹ For example, outdoor-gear retailer Recreational Equipment Inc. has partnered with external providers to manage customers' requests and inquiries related to in-store pickups of online orders. This has allowed REI to improve its in-store inventory utilization by better matching stock availability with demand.

Clearly, no “one-size-fits-all” network structure applies to Internet retailers. What's more, the “right” answer will keep changing if Internet retail sales continue to grow at 25% per year. The decision ranks among the most critical of strategic issues, however, due to the capital implications of vertical integration and the “lock-in” risks of picking the wrong network partners. The best Internet retailers will invest in a network architecture that fits their specific product characteristics and strategic competencies at a price they can afford.

Deploy Inventory to Profitably Meet Customer Needs

As their distribution networks grow larger, pure-play online retailers will face increasingly complicated decisions re-

Although Internet retailing purports to offer a “virtual” inventory model unconstrained by the limits of a physical store, for fast delivery the product needs to be stored somewhere by someone along the supply chain. Amazon.com, for example, offers more than 10 million book titles, 50 times that of a typical Borders superstore and 400 times that of a mall-based bookstore. But Amazon fulfillment centers carry only a fraction of the titles offered; wholesalers hold many additional titles for rapid delivery to Amazon, while other titles must be sourced directly from the publishers. Some out-of-print titles can be sourced only from used or closeout specialist bookstores.

To decide whether to hold a book in-house or to order as needed from a distributor, Amazon must do more than calculate the cost of carrying a book under each option. The company must also consider whether to stock the book at a single facility or to duplicate inventory across multiple locations. Further complicating matters, Amazon must consider the impact of complementary or bundled products in every order, since

chains comprising “speculative,” forward-deployed inventory and “postponed” stocks held at supplier locations rather than in-house. We found that a 50% increase in transshipments raises average transportation costs per order by 21% but reduces average back-order time by 8.5 hours.¹¹ Good service, including in-stock availability, proves paramount for sellers of commodity products such as CDs because consumers can easily divert their purchases to another retailer with better availability. Outsourcing considerations also enter into the equation. Aligning incentives along the supply chain can reinforce delivery performance and perhaps allow even better promises in subsequent orders.

Inventory deployment presents greater challenges to multichannel retailers, which offer products through both a Web site and physical stores: What can or should be made available exclusively online, at the store only or both, and how to price accordingly? Poor inventory visibility presents one of the greatest barriers to the effective integration of offline and online retail operations. Research on retail operations

execution has highlighted the poor understanding that most retailers have of actual inventory levels in a given store. One rigorous analysis of a sophisticated, multibillion-dollar chain found inaccurate records for 65% of the stocked items, with an average error of 35%.¹²

For multichannel retailers, where to optimally deploy inventory naturally depends on fundamental issues such as the network architecture and degree of outsourcing. But beyond those system design considerations, these retailers should take into account the salient characteristics of the products being sold and the customers buying them. Consider how product characteristics determine electronics retailer Circuit City Stores Inc.'s cost-to-serve and optimal inventory deployments.¹³ Circuit City can gain significant transportation savings by shipping a bulky item, such as a wide-screen television, in full truckload shipments through its nine regional distribution centers serving its 621 domestic stores — whether a customer orders it online or at the store. At the other extreme, the most expensive camcorders weigh less than a couple of pounds and accordingly can be shipped by UPS

ground service relatively cheaply.

Furthermore, if the camcorder has low unit sales, Circuit City might decide against stocking it in the stores at all due to the inventory carrying cost, including the risk of obsolescence. But a “pooled” central inventory offered exclusively over the Web site and held in a central distribution center might be justified, since far fewer units of inventory would be required.

Brick-and-mortar retailers can find a great advantage in the combination of Web sales and in-store pickup. Drugstore chain Walgreen Co., for example, allows customers to use its Web-based prescription ordering tools to schedule medication refills and pickups at a store of their choice among thousands across the United States. The advantage for Walgreen's customers comes from the ability to schedule and track their prescription refills. Although clearly a customer convenience, the scheduling feature has also given Walgreen's a powerful tool to forecast a category that accounts for more than 60% of its annual sales and better plan the prescription processing workflow at its stores. This has led to better inventory management and personnel

utilization, as well as fewer customers waiting for their prescriptions at the stores.

Although optimal inventory deployment must start with an understanding of customer preferences, it need not stop there. Customer behaviors can be changed with a compelling alternative value proposition. Often, the key comes from breaking traditional constraints, such as offering low cost and high quality, or speed and variety. The virtual nature of Internet retailing enables new possibilities, just as the introduction of big-box retailing 30 years ago presented consumers with a fundamentally new combination of low cost and high variety. Savvy Internet retailers are focusing on the unique opportunities of the online channel to create new service models that offer a superior value proposition to their targeted consumers. But most importantly, optimizing operational performance in Internet retailing will require understanding and managing the details.

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